

## SEQUENCE LISTING

<110> OHTAKI, Hiromi

NAKAMURA, Jun

IZUI, Hiroshi

NAKAMATSU, Tsuyoshi

<120> Bacterium Producing L-Glutamic Acid and Method for Producing L-Glutamic Acid

<130> OP1195

<140>

<141> 2000-07-

<150> JP 2000-204256

<151> 2000-07-05

<160> 34

<170> PatentIn Ver. 2.0

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 ttaaacactc aggaggatcc ttgccggcca aaatcacgga cactcgtccc accccagaat 180  
 cccttcacgc tgttgaagag gaaaccgcag ccggtgcccg caggattggt gccacctatt 240  
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 tgcgttacac caaggtcgct tctgaacacg aggaagctca gccaaagaag gctacaaagc 360  
 ggactcgtaa ggctaccagc taagaaggct gctgctaaga aaacgaccaa gaagaccact 420  
 aagaaaacta ctaaaaagac caccgcaaag aagaccacaa agaagtctta agccgatctt 480  
 tat atg gat gat tcc aat agc ttt gta gtt gtt gct aac cgt ctg cca 528

Met Asp Asp Ser Asn Ser Phe Val Val Val Ala Asn Arg Leu Pro

09995382-070201

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gtg gat atg act gtc cac cca gat ggt agc tat agc atc tcc ccc agc	576			
Val Asp Met Thr Val His Pro Asp Gly Ser Tyr Ser Ile Ser Pro Ser				
20	25	30		
ccc ggt ggc ctt gtc acg ggg ctt tcc ccc gtt ctg gaa caa cat cgt	624			
Pro Gly Gly Leu Val Thr Gly Leu Ser Pro Val Leu Glu Gln His Arg				
35	40	45		
gga tgt tgg gtc gga tgg cct gga act gta gat gtt gca ccc gaa cca	672			
Gly Cys Trp Val Gly Trp Pro Gly Thr Val Asp Val Ala Pro Glu Pro				
50	55	60		
ttt cga aca gat acg ggt gtt ttg ctg cac cct gtt gtc ctc act gca	720			
Phe Arg Thr Asp Thr Gly Val Leu Leu His Pro Val Val Leu Thr Ala				
65	70	75		
agt gac tat gaa ggc ttc tac gag ggc ttt tca aac gca acg ctg tgg	768			
Ser Asp Tyr Glu Gly Phe Tyr Glu Gly Phe Ser Asn Ala Thr Leu Trp				
80	85	90	95	
cct ctt ttc cac gat ctg att gtt act ccg gtg tac aac acc gat tgg	816			
Pro Leu Phe His Asp Leu Ile Val Thr Pro Val Tyr Asn Thr Asp Trp				
100	105	110		
tgg cat gcg ttt cgg gaa gta aac ctc aag ttc gct gaa gcc gtg agc	864			
Trp His Ala Phe Arg Glu Val Asn Leu Lys Phe Ala Glu Ala Val Ser				
115	120	125		
caa gtg gcg gca cac ggt gcc act gtg tgg gtg cag gac tat cag ctg	912			
Gln Val Ala Ala His Gly Ala Thr Val Trp Val Gln Asp Tyr Gln Leu				
130	135	140		
ttg ctg gtt cct ggc att ttg cgc cag atg cgc ctt gat ttg aag atc	960			
Leu Leu Val Pro Gly Ile Leu Arg Gln Met Arg Leu Asp Leu Lys Ile				
145	150	155		
ggt ttc ttc ctc cac att ccc ttc cct tcc cct gat ctg ttc cgt cag	1008			
Gly Phe Phe Leu His Ile Pro Phe Pro Ser Pro Asp Leu Phe Arg Gln				
160	165	170	175	
ctg ccg tgg cgt gaa gag att gtt cga ggc atg ctg ggc gca gat ttg	1056			
Leu Pro Trp Arg Glu Glu Ile Val Arg Gly Met Leu Gly Ala Asp Leu				
180	185	190		
gtg gga ttc cat ttg gtt caa aac gca gaa aac ttc ctt gcg tta acc	1104			
Val Gly Phe His Leu Val Gln Asn Ala Glu Asn Phe Leu Ala Leu Thr				
195	200	205		
cag cag gtt gcc ggc act gcc ggg tct cat gtg ggt cag ccg gac acc	1152			
Gln Gln Val Ala Gly Thr Ala Gly Ser His Val Gly Gln Pro Asp Thr				
210	215	220		
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Leu Gln Val Ser Gly Glu Ala Leu Val Arg Glu Ile Gly Ala His Val  
 225 230 235  
 gaa acc gct gac gga agg cga gtt agc gtc ggg gcg ttc ccg atc tcg 1248  
 Glu Thr Ala Asp Gly Arg Arg Val Ser Val Gly Ala Phe Pro Ile Ser  
 240 245 250 255  
 att gat gtt gaa atg ttt ggg gag gcg tcg aaa agc gcc gtt ctt gat 1296  
 Ile Asp Val Glu Met Phe Gly Glu Ala Ser Lys Ser Ala Val Leu Asp  
 260 265 270  
 ctt tta aaa acg ctc gac gag ccg gaa acc gta ttc ctg ggc gtt gac 1344  
 Leu Leu Lys Thr Leu Asp Glu Pro Glu Thr Val Phe Leu Gly Val Asp  
 275 280 285  
 cga ctg gac tac acc aag ggc att ttg cag cgc ctg ctt gcg ttt gag 1392  
 Arg Leu Asp Tyr Thr Lys Gly Ile Leu Gln Arg Leu Leu Ala Phe Glu  
 290 295 300  
 gaa ctg ctg gaa tcc ggc gcg ttg gag gcc gac aaa gct gtg ttg ctg 1440  
 Glu Leu Leu Glu Ser Gly Ala Leu Glu Ala Asp Lys Ala Val Leu Leu  
 305 310 315  
 cag gtc gcg acg cct tcg cgt gag cgc att gat cac tat cgt gtg tcg 1488  
 Gln Val Ala Thr Pro Ser Arg Glu Arg Ile Asp His Tyr Arg Val Ser  
 320 325 330 335  
 cgt tcg cag gtc gag gaa gcc gtc ggc cgt atc aat ggt cgt ttc ggt 1536  
 Arg Ser Gln Val Glu Glu Ala Val Gly Arg Ile Asn Gly Arg Phe Gly  
 340 345 350  
 cgc atg ggg cgt ccc gtg gtg cat tat cta cac agg tca ttg agc aaa 1584  
 Arg Met Gly Arg Pro Val Val His Tyr Leu His Arg Ser Leu Ser Lys  
 355 360 365  
 aat gat ctc cag gtg ctg tat acc gca gcc gat gtc atg ctg gtt acg 1632  
 Asn Asp Leu Gln Val Leu Tyr Thr Ala Ala Asp Val Met Leu Val Thr  
 370 375 380  
 cct ttt aaa gac ggt atg aac ttg gtg gct aaa gaa ttc gtg gcc aac 1680  
 Pro Phe Lys Asp Gly Met Asn Leu Val Ala Lys Glu Phe Val Ala Asn  
 385 390 395  
 cac cgc gac ggc act ggt gct ttg gtg ctg tcc gaa ttt gcc ggc gcg 1728  
 His Arg Asp Gly Thr Gly Ala Leu Val Leu Ser Glu Phe Ala Gly Ala  
 400 405 410 415  
 gcc act gag ctg acc ggt gcg tat tta tgc aac cca ttt gat gtg gaa 1776  
 Ala Thr Glu Leu Thr Gly Ala Tyr Leu Cys Asn Pro Phe Asp Val Glu  
 420 425 430  
 tcc atc aaa cgg caa atg gtg gca gct gtc cat gat ttg aag cac aat 1824  
 Ser Ile Lys Arg Gln Met Val Ala Ala Val His Asp Leu Lys His Asn  
 435 440 445

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ccg gaa tct gcg gca acg cga atg aaa acg aac agc gag cag gtc tat 1872  
 Pro Glu Ser Ala Ala Thr Arg Met Lys Thr Asn Ser Glu Gln Val Tyr  
           450                          455                          460  
 acc cac gac gtc aac gtg tgg gct aat agt ttc ctg gat tgt ttg gcg 1920  
 Thr His Asp Val Asn Val Trp Ala Asn Ser Phe Leu Asp Cys Leu Ala  
           465                          470                          475  
 cag tcg gga gaa aac tca tgaaccgcgc acgaatcgcg accataggcg 1968  
 Gln Ser Gly Glu Asn Ser  
 480                          485  
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<213> *Brevibacterium lactofermentum*

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           20                          25                          30  
 Gly Gly Leu Val Thr Gly Leu Ser Pro Val Leu Glu Gln His Arg Gly  
           35                          40                          45  
 Cys Trp Val Gly Trp Pro Gly Thr Val Asp Val Ala Pro Glu Pro Phe  
           50                          55                          60  
 Arg Thr Asp Thr Gly Val Leu Leu His Pro Val Val Leu Thr Ala Ser  
   65                          70                          75                          80  
 Asp Tyr Glu Gly Phe Tyr Glu Gly Phe Ser Asn Ala Thr Leu Trp Pro  
           85                          90                          95  
 Leu Phe His Asp Leu Ile Val Thr Pro Val Tyr Asn Thr Asp Trp Trp  
           100                          105                          110  
 His Ala Phe Arg Glu Val Asn Leu Lys Phe Ala Glu Ala Val Ser Gln  
           115                          120                          125  
 Val Ala Ala His Gly Ala Thr Val Trp Val Gln Asp Tyr Gln Leu Leu  
           130                          135                          140

09095383 070204

Leu Val Pro Gly Ile Leu Arg Gln Met Arg Leu Asp Leu Lys Ile Gly  
 145 150 155 160  
 Phe Phe Leu His Ile Pro Phe Pro Ser Pro Asp Leu Phe Arg Gln Leu  
 165 170 175  
 Pro Trp Arg Glu Glu Ile Val Arg Gly Met Leu Gly Ala Asp Leu Val  
 180 185 190  
 Gly Phe His Leu Val Gln Asn Ala Glu Asn Phe Leu Ala Leu Thr Gln  
 195 200 205  
 Gln Val Ala Gly Thr Ala Gly Ser His Val Gly Gln Pro Asp Thr Leu  
 210 215 220  
 Gln Val Ser Gly Glu Ala Leu Val Arg Glu Ile Gly Ala His Val Glu  
 225 230 235 240  
 Thr Ala Asp Gly Arg Arg Val Ser Val Gly Ala Phe Pro Ile Ser Ile  
 245 250 255  
 Asp Val Glu Met Phe Gly Glu Ala Ser Lys Ser Ala Val Leu Asp Leu  
 260 265 270  
 Leu Lys Thr Leu Asp Glu Pro Glu Thr Val Phe Leu Gly Val Asp Arg  
 275 280 285  
 Leu Asp Tyr Thr Lys Gly Ile Leu Gln Arg Leu Leu Ala Phe Glu Glu  
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 Val Ala Thr Pro Ser Arg Glu Arg Ile Asp His Tyr Arg Val Ser Arg  
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 Ser Gln Val Glu Glu Ala Val Gly Arg Ile Asn Gly Arg Phe Gly Arg  
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 Met Gly Arg Pro Val Val His Tyr Leu His Arg Ser Leu Ser Lys Asn  
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 Asp Leu Gln Val Leu Tyr Thr Ala Ala Asp Val Met Leu Val Thr Pro  
 370 375 380  
 Phe Lys Asp Gly Met Asn Leu Val Ala Lys Glu Phe Val Ala Asn His  
 385 390 395 400  
 Arg Asp Gly Thr Gly Ala Leu Val Leu Ser Glu Phe Ala Gly Ala Ala  
 405 410 415  
 Thr Glu Leu Thr Gly Ala Tyr Leu Cys Asn Pro Phe Asp Val Glu Ser  
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			Met Ala Arg	Pro Ile	Ser Ala Thr Tyr Arg										
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ctt caa atg	cga gga cct	caa gca	gat agc gcc	ggg cgt ttc	ttt ggt	159									
Leu Gln Met	Arg Gly Pro	Gln Ala	Asp Ser Ala	Gly Arg Phe	Phe Gly										
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Phe Ala Gln	Ala Lys Ala	Gln Leu Pro	Tyr Leu Lys	Lys Leu Gly	Ile										
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agc cac ctg	tac ctc tcc	cct att ttt	acg gcc atg	cca gat tcc	aat	255									
Ser His Leu	Tyr Leu Ser	Pro Ile Phe	Thr Ala Met	Pro Asp Ser	Asn										
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His Gly Tyr	Asp Val Ile	Asp Pro Thr	Ala Ile Asn	Glu Glu Leu	Gly										
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ggc atg gag	ggt ctt cga	gat ctt gct	gca gct aca	cac gag ttg	ggc	351									
Gly Met Glu	Gly Leu Arg	Asp Leu Ala	Ala Ala Thr	His Glu Leu	Gly										
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atg ggc atc	atc att gat	att gtt ccc	aac cat tta	ggt gtt gcc	gtt	399									
Met Gly Ile	Ile Ile Asp	Ile Val Pro	Asn His Leu	Gly Val Ala	Val										
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Pro His Leu Asn Pro Trp Trp Trp Asp Val Leu Lys Asn Gly Lys Asp  
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Ser Ala Phe Glu Phe Tyr Phe Asp Ile Asp Trp His Glu Asp Asn Gly  
125 130 135

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Ser Gly Gly Lys Leu Gly Met Pro Ile Leu Gly Ala Glu Gly Asp Glu  
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Asp Lys Leu Glu Phe Ala Glu Leu Asp Gly Glu Lys Val Leu Lys Tyr  
155 160 165 170

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Phe Asp His Leu Phe Pro Ile Ala Pro Gly Thr Glu Glu Gly Thr Pro  
175 180 185

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Gln Glu Val Tyr Lys Arg Gln His Tyr Arg Leu Gln Phe Trp Arg Asp  
190 195 200

ggc gtg atc aac ttc cgt cgc ttc ttt tcc gtg aat acg ttg gct ggc 735  
Gly Val Ile Asn Phe Arg Arg Phe Phe Ser Val Asn Thr Leu Ala Gly  
205 210 215

atc agg caa gaa gat ccc ttg gtg ttt gaa cat act cat cgt ctg ctg 783  
Ile Arg Gln Glu Asp Pro Leu Val Phe Glu His Thr His Arg Leu Leu  
220 225 230

cgc gaa ttg gtg gcg gaa gac ctc att gac ggc gtg cgc gtc gat cac 831  
Arg Glu Leu Val Ala Glu Asp Leu Ile Asp Gly Val Arg Val Asp His  
235 240 245 250

ccc gac ggc ctt tcc gat cct ttt gga tat ctg cac aga ctc cgc gac 879  
Pro Asp Gly Leu Ser Asp Pro Phe Gly Tyr Leu His Arg Leu Arg Asp  
255 260 265

ctc att gga cct gac cgc tgg ctg atc atc gaa aag atc ttg agc gtt 927  
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270 275 280

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Asp Glu Pro Leu Asp Pro Arg Leu Ala Val Asp Gly Thr Thr Gly Tyr  
285 290 295

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Asp Pro Leu Arg Glu Leu Asp Gly Val Phe Ile Ser Arg Glu Ser Glu  
300 305 310

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Asp Lys Phe Ser Met Leu Ala Leu Thr His Ser Gly Ser Thr Trp Asp

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 Glu Arg Ala Leu Lys Ser Thr Glu Glu Ser Leu Lys Arg Val Val Ala  
                     335                      340                      345  
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                     350                      355                      360  
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 Arg Asp Asn Phe Ser Thr Ala Gly Thr Asn Val Thr Glu Asp Lys Leu  
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 gac tac atc tcc ctc tca cgc acc acc gcc acc gtc atc gcg gag atg 1311  
 Asp Tyr Ile Ser Leu Ser Arg Thr Thr Ala Thr Val Ile Ala Glu Met  
 395                      400                      405                      410  
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                     415                      420                      425  
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 Ala Leu Leu Gly Asn Gly Glu Ala Lys Ile Arg Phe Ala Gln Val Cys  
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 Gly Ala Val Met Ala Lys Gly Val Glu Asp Thr Thr Phe Tyr Arg Ala  
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 Ser Arg Leu Val Ala Leu Gln Glu Val Gly Gly Ala Pro Gly Arg Phe  
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 Gly Val Ser Ala Ala Glu Phe His Leu Leu Gln Glu Glu Arg Ser Leu  
 475                      480                      485                      490  
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 Leu Trp Pro Arg Thr Met Thr Thr Leu Ser Thr His Asp Thr Lys Arg  
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 ggc gaa gat acc cgc gcc cgc atc atc tcc ctg tcc gaa gtc ccc gat 1647  
 Gly Glu Asp Thr Arg Ala Arg Ile Ile Ser Leu Ser Glu Val Pro Asp  
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 atg tac tcc gag ctg gtc aat cgt gtt ttc gca gtg ctc ccc gcg cca 1695  
 Met Tyr Ser Glu Leu Val Asn Arg Val Phe Ala Val Leu Pro Ala Pro  
                     525                      530                      535  
 gac ggc gca acg ggc agt ttc ctc cta caa aac ctg ctg ggc gta tgg 1743

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Asp Gly Ala Thr Gly Ser Phe Leu Leu Gln Asn Leu Leu Gly Val Trp	
540 545 550	
ccc gcc gac ggc gtg atc acc gat gcg ctg cgc gat cga ttc agg gaa	1791
Pro Ala Asp Gly Val Ile Thr Asp Ala Leu Arg Asp Arg Phe Arg Glu	
555 560 565 570	
tac gcc cta aaa get atc cgc gaa gca tcc aca aaa acc acg tgg gtg	1839
Tyr Ala Leu Lys Ala Ile Arg Glu Ala Ser Thr Lys Thr Thr Trp Val	
575 580 585	
gac ccc aac gag tcc ttc gag gct gcg gtc tgc gat tgg gtg gaa gcg	1887
Asp Pro Asn Glu Ser Phe Glu Ala Ala Val Cys Asp Trp Val Glu Ala	
590 595 600	
ctt ttc gac gga ccc tcc acc tca tta atc acc gaa ttt gtc tcc cac	1935
Leu Phe Asp Gly Pro Ser Thr Ser Leu Ile Thr Glu Phe Val Ser His	
605 610 615	
atc aac cgt ggc tct gtg aat atc tcc tta ggt agg aaa ctg ctg caa	1983
Ile Asn Arg Gly Ser Val Asn Ile Ser Leu Gly Arg Lys Leu Leu Gln	
620 625 630	
atg gtg ggc gct gga atc ccc gac act tac caa gga act gag ttt tta	2031
Met Val Gly Ala Gly Ile Pro Asp Thr Tyr Gln Gly Thr Glu Phe Leu	
635 640 645 650	
gaa gac tcc ctg gta gat ccc gat aac cga cgc ttt gtt gat tac acc	2079
Glu Asp Ser Leu Val Asp Pro Asp Asn Arg Arg Phe Val Asp Tyr Thr	
655 660 665	
gcc aga gaa caa gtc ctg gag cgc ctg caa acc tgg gat tgg acg cag	2127
Ala Arg Glu Gln Val Leu Glu Arg Leu Gln Thr Trp Asp Trp Thr Gln	
670 675 680	
gtt aat tcg gta gaa gac ttg gtg gat aac gcc gac atc gcc aaa atg	2175
Val Asn Ser Val Glu Asp Leu Val Asp Asn Ala Asp Ile Ala Lys Met	
685 690 695	
gcc gtg gtc cat aaa tcc ctc gag ttg cgt gct gaa ttt cgt gca agc	2223
Ala Val Val His Lys Ser Leu Glu Leu Arg Ala Glu Phe Arg Ala Ser	
700 705 710	
ttt gtt ggt gga gat cat cag gca gta ttt ggc gaa ggt cgc gca gaa	2271
Phe Val Gly Gly Asp His Gln Ala Val Phe Gly Glu Gly Arg Ala Glu	
715 720 725 730	
tcc cac atc atg ggc atc gcc cgc ggt aca gac cga aac cac ctc aac	2319
Ser His Ile Met Gly Ile Ala Arg Gly Thr Asp Arg Asn His Leu Asn	
735 740 745	
atc att gct ctt gct acc cgt cga cca ctg atc ttg gaa gac cgt ggc	2367
Ile Ile Ala Leu Ala Thr Arg Arg Pro Leu Ile Leu Glu Asp Arg Gly	
750 755 760	

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 agg ctc acc ggg caa cgc ttc agt ggt gtt gtc cca gcc acc gat ttg 2463  
 Arg Leu Thr Gly Gln Arg Phe Ser Gly Val Val Pro Ala Thr Asp Leu  
 780 785 790  
 ttc tca cat tta ccc gta tct ttg ttg gtt tta gta ccc gat agt gag 2511  
 Phe Ser His Leu Pro Val Ser Leu Leu Val Leu Val Pro Asp Ser Glu  
 795 800 805 810  
 ttt tgatccctgc acaggaaagt tagcggcgct actatgaacg atcgatatgt 2564  
 Phe  
 ctgacaacac tctctcccaa tttggcagtt actaccacga attccgacgt gcccatccca 2624  
 tggccgacgt cgaattcctc ctgcaattg aagaattact cacagacggt ggtgtcacct 2684  
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<211> 811

<212> PRT

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 Gln Leu Pro Tyr Leu Lys Lys Leu Gly Ile Ser His Leu Tyr Leu Ser  
 35 40 45  
 Pro Ile Phe Thr Ala Met Pro Asp Ser Asn His Gly Tyr Asp Val Ile  
 50 55 60  
 Asp Pro Thr Ala Ile Asn Glu Glu Leu Gly Gly Met Glu Gly Leu Arg  
 65 70 75 80  
 Asp Leu Ala Ala Ala Thr His Glu Leu Gly Met Gly Ile Ile Ile Asp  
 85 90 95  
 Ile Val Pro Asn His Leu Gly Val Ala Val Pro His Leu Asn Pro Trp  
 100 105 110  
 Trp Trp Asp Val Leu Lys Asn Gly Lys Asp Ser Ala Phe Glu Phe Tyr  
 115 120 125

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Phe Asp Ile Asp Trp His Glu Asp Asn Gly Ser Gly Gly Lys Leu Gly  
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 Met Pro Ile Leu Gly Ala Glu Gly Asp Glu Asp Lys Leu Glu Phe Ala  
 145 150 155 160  
 Glu Leu Asp Gly Glu Lys Val Leu Lys Tyr Phe Asp His Leu Phe Pro  
 165 170 175  
 Ile Ala Pro Gly Thr Glu Glu Gly Thr Pro Gln Glu Val Tyr Lys Arg  
 180 185 190  
 Gln His Tyr Arg Leu Gln Phe Trp Arg Asp Gly Val Ile Asn Phe Arg  
 195 200 205  
 Arg Phe Phe Ser Val Asn Thr Leu Ala Gly Ile Arg Gln Glu Asp Pro  
 210 215 220  
 Leu Val Phe Glu His Thr His Arg Leu Leu Arg Glu Leu Val Ala Glu  
 225 230 235 240  
 Asp Leu Ile Asp Gly Val Arg Val Asp His Pro Asp Gly Leu Ser Asp  
 245 250 255  
 Pro Phe Gly Tyr Leu His Arg Leu Arg Asp Leu Ile Gly Pro Asp Arg  
 260 265 270  
 Trp Leu Ile Ile Glu Lys Ile Leu Ser Val Asp Glu Pro Leu Asp Pro  
 275 280 285  
 Arg Leu Ala Val Asp Gly Thr Thr Gly Tyr Asp Pro Leu Arg Glu Leu  
 290 295 300  
 Asp Gly Val Phe Ile Ser Arg Glu Ser Glu Asp Lys Phe Ser Met Leu  
 305 310 315 320  
 Ala Leu Thr His Ser Gly Ser Thr Trp Asp Glu Arg Ala Leu Lys Ser  
 325 330 335  
 Thr Glu Glu Ser Leu Lys Arg Val Val Ala Gln Gln Glu Leu Ala Ala  
 340 345 350  
 Glu Ile Leu Arg Leu Ala Arg Ala Met Arg Arg Asp Asn Phe Ser Thr  
 355 360 365  
 Ala Gly Thr Asn Val Thr Glu Asp Lys Leu Ser Glu Thr Ile Ile Glu  
 370 375 380  
 Leu Val Ala Ala Met Pro Val Tyr Arg Ala Asp Tyr Ile Ser Leu Ser  
 385 390 395 400  
 Arg Thr Thr Ala Thr Val Ile Ala Glu Met Ser Lys Arg Phe Pro Ser  
 405 410 415  
 Arg Arg Asp Ala Leu Asp Leu Ile Ser Ala Ala Leu Leu Gly Asn Gly  
 420 425 430  
 Glu Ala Lys Ile Arg Phe Ala Gln Val Cys Gly Ala Val Met Ala Lys  
 435 440 445  
 Gly Val Glu Asp Thr Thr Phe Tyr Arg Ala Ser Arg Leu Val Ala Leu

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 Gln Glu Val Gly Gly Ala Pro Gly Arg Phe Gly Val Ser Ala Ala Glu  
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 Phe His Leu Leu Gln Glu Glu Arg Ser Leu Leu Trp Pro Arg Thr Met  
                     485                      490                      495  
 Thr Thr Leu Ser Thr His Asp Thr Lys Arg Gly Glu Asp Thr Arg Ala  
                     500                      505                      510  
 Arg Ile Ile Ser Leu Ser Glu Val Pro Asp Met Tyr Ser Glu Leu Val  
                     515                      520                      525  
 Asn Arg Val Phe Ala Val Leu Pro Ala Pro Asp Gly Ala Thr Gly Ser  
                     530                      535                      540  
 Phe Leu Leu Gln Asn Leu Leu Gly Val Trp Pro Ala Asp Gly Val Ile  
 545                      550                      555                      560  
 Thr Asp Ala Leu Arg Asp Arg Phe Arg Glu Tyr Ala Leu Lys Ala Ile  
                     565                      570                      575  
 Arg Glu Ala Ser Thr Lys Thr Thr Trp Val Asp Pro Asn Glu Ser Phe  
                     580                      585                      590  
 Glu Ala Ala Val Cys Asp Trp Val Glu Ala Leu Phe Asp Gly Pro Ser  
                     595                      600                      605  
 Thr Ser Leu Ile Thr Glu Phe Val Ser His Ile Asn Arg Gly Ser Val  
                     610                      615                      620  
 Asn Ile Ser Leu Gly Arg Lys Leu Leu Gln Met Val Gly Ala Gly Ile  
 625                      630                      635                      640  
 Pro Asp Thr Tyr Gln Gly Thr Glu Phe Leu Glu Asp Ser Leu Val Asp  
                     645                      650                      655  
 Pro Asp Asn Arg Arg Phe Val Asp Tyr Thr Ala Arg Glu Gln Val Leu  
                     660                      665                      670  
 Glu Arg Leu Gln Thr Trp Asp Trp Thr Gln Val Asn Ser Val Glu Asp  
                     675                      680                      685  
 Leu Val Asp Asn Ala Asp Ile Ala Lys Met Ala Val Val His Lys Ser  
                     690                      695                      700  
 Leu Glu Leu Arg Ala Glu Phe Arg Ala Ser Phe Val Gly Gly Asp His  
 705                      710                      715                      720  
 Gln Ala Val Phe Gly Glu Gly Arg Ala Glu Ser His Ile Met Gly Ile  
                     725                      730                      735  
 Ala Arg Gly Thr Asp Arg Asn His Leu Asn Ile Ile Ala Leu Ala Thr  
                     740                      745                      750  
 Arg Arg Pro Leu Ile Leu Glu Asp Arg Gly Gly Trp Tyr Asp Thr Thr  
                     755                      760                      765  
 Val Thr Leu Pro Gly Gly Gln Trp Glu Asp Arg Leu Thr Gly Gln Arg  
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<213> Artificial Sequence

<223> Description of Artificial Sequence: primer for PCR

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### <213> Artificial Sequence

<223> Description of Artificial Sequence: primer for PCR

cttgatcgat taaaaacgct cgacgagccg 30